



Illinois Department of Transportation

2300 South Dirksen Parkway / Springfield, Illinois / 62764

BDE PROCEDURE MEMORANDUM

NUMBER: 30-02A

SUBJECT: Roadside Barriers, Median Barriers, and Terminals

DATE: September 17, 2002

This memorandum supersedes and replaces BDE Procedure Memorandum 30-02 dated July 1, 2002. This memorandum is being issued to transmit revisions in Section 38-5.01(a) Item 3 and 38-6.06(c) Item 3 through 10 of the BDE Procedure Memorandum.

Background

Previous IDOT applications of barriers, terminals, and crash cushions were designed to various performance standards. Current FHWA policy will require that all roadside safety hardware used on National Highway System (NHS) Routes be accepted under National Cooperative Highway Research Program Report 350 (NCHRP 350) criteria. This memorandum will update the affected Articles of Chapter 38 to list and give guidance on hardware that is accepted by the FHWA under NCHRP 350.

Applicability

The following procedures are applicable to projects on the State highway system, effective October 1, 2002. Also, any items used on a case-by-case basis shall comply with the appropriate NCHRP 350 criteria.

Generally the devices listed herein are accepted at Test Level 3 under the NCHRP 350 criteria. When the design speed is 45 mph (70 km/hr) or less, the designer may consider specifications for devices accepted at Test Level 2. Contact the BDE for further information.

Procedures

38-5.01(a) Steel Plate Beam Guardrail

The steel plate beam guardrail, commonly known as the "W"-beam system, with strong posts is a semi-rigid system. In general, this guardrail system is the preferred selection on non-freeways and on rural freeways. A major objective of the strong post system is to prevent a vehicle from "snagging" on the posts. This is achieved by using blockouts to offset the posts from the longitudinal beam and by establishing 6'-3" (1905 mm) as the maximum allowable post spacing.

The Department has developed several variations of the steel plate beam guardrail for various applications:

1. Type A. The Type A guardrail uses the typical 6'-3" (1905 mm) post spacing, and it is the most commonly used barrier system in Illinois. Type A has a deflection distance of 3' (920 mm).
2. Type B. The Type B guardrail uses a post spacing of 3'-1 1/2" (953 mm) and has a deflection distance of 2' (600 mm). It is used where the deflection distance for the Type A system is unavailable.
3. Type C. The Type C guardrail is a single rail that is attached directly to rigid objects where vehicle impacts are not expected, and where it is necessary or desirable to carry the guardrail across the face of a structure. Limited applications of this Type are expected, such as attachment to a building outside the clear zone where the guardrail is used as a delineation element rather than a roadside barrier. Normally, guardrail shall be attached to concrete structures, such as piers, in a manner similar to that applied by Article 38-6.06(c) for attachment at bridges.
4. Type D. See Section 38-7.02 of the BDE Manual for the use of this Type. It is a double-face guardrail system used as a median barrier.
5. Attached to Headwalls. The Department has developed an adaptation of the steel plate beam guardrail specifically for attachment to concrete headwalls near the edge of shoulder.

38-6.06 Terminal Treatments

Barrier terminal sections present a potential roadside hazard for run-off-the-road vehicles; however, they are also critical to the proper structural performance of the barrier system. Therefore, the designer must carefully consider the selection and placement of the terminal end.

The *Illinois Highway Standards* present the design details for several end treatments used by the Department. Other proprietary terminal treatments are allowed under various Specifications and Special Provisions. The particular proprietary items routinely allowed for use on IDOT projects are included in the Department's "Special Notice" included periodically in the Notice of Letting. The following sections briefly describe each system, and where applicable, discuss typical uses of the system.

The various end treatments may allow a portion of the terminal to be included in the length of need. The designer should include any applicable portion when determining the location of the terminal.

38-6.06(a) Guardrail Ends

Type 1, Special (Flared). This terminal section is intended for use with steel plate beam guardrail. All approved terminals meet NCHRP 350 criteria. The designer should choose a flared terminal where possible, as long as no additional R.O.W. needs to be purchased for installation. Specifications require that all Type 1 Special (Flared) terminals provide 37.5' (11.4 m) length of need. The leading portion of the terminal is normally a gating design and not included in the length of need. Because of the gating function, the area behind and beyond the terminal should be relatively free of significant fixed objects. The minimum recommended distance is a rectangular area approximately 75' (23 m) beyond the terminal parallel to the rail and 20' (6 m) behind and perpendicular to the rail.

Type 1, Special (Tangent). This is a terminal section intended for use with steel plate beam guardrail. All approved terminals meet NCHRP 350 criteria. Tangent terminals should be chosen in areas where the cross section or drainage structure would require additional right of way to accommodate the Type 1 Special (Flared) terminal. Specifications require that all Type 1 Special (Tangent) terminals provide 37.5' (11.4 m) length of need. The leading portion of the terminal is normally a gating design and not included in the length of need. Because of the gating function, the area behind and beyond the terminal should be relatively free of significant fixed objects. The minimum recommended distance is a rectangular area approximately 75' (23 m) beyond the terminal parallel to the rail and 20' (6 m) behind and perpendicular to the rail.

Type 1B. This terminal should be used at the approaching or departing (where practical) end of roadside barriers where appropriate cut or artificial mound conditions exist or can be reasonably constructed.

Type 2. This is an unflared terminal with a cable anchor. The Type 2 should be used on the departing end of steel plate beam guardrail where end-on impacts are not a consideration; i.e., on one-way roadways. The length of this terminal should not be considered as part of the length of need required to shield the hazard.

38-6.06(b) Median Barrier Ends

See Section 38-7.04(d) for guidance on Department approved end terminals for median barriers (Traffic Barrier Terminal, Type 3 (Special)). These also apply to the ends of the concrete median barrier where it is used as a roadside barrier.

38-6.06(c) Bridge Rail Connections

1. Type 5. This is a connector terminal that should be used to connect steel plate beam guardrail to the concrete bridge parapet or end post at the departing end of a new one-way bridge.
2. Type 5A. This is a connector terminal that should only be used for repair of existing installations on the State system, and for Local Roads projects, if specified by the Local Agency. It is used to connect steel plate beam guardrail to a steel bridge rail at either the approaching end or departing end of the bridge. For applications on the State system, or other locations where compliance with NCHRP 350 is required, see Type 6.
3. Type 6. Recent modifications to the design of this terminal bring it into compliance with NCHRP 350. This is a connector terminal that includes a transition section, special posts, blockouts, end shoe. It also requires the use of a curb. The Type 6 should be used to attach steel plate beam guardrail to the end(s) of bridges with concrete parapet or to a permanent concrete barrier. It may also be used to connect the steel plate beam guardrail to the face of the other concrete structures where the related curb can be installed.
4. Type 6A. This transition is similar to the Type 6, except it is for attachment of steel plate beam guardrail to either curb mounted steel bridge rail, or to side mounted steel bridge rail (two element rail systems approved under NCHRP 350). When used with a bridge rail system that includes a curb, a curb must be used with the Type 6A, similar to the Type 6. If there is no curb used on the bridge, a curb should not be used with the Type 6A.
5. Type 6B. This transition is for use when connecting steel plate beam guardrail to the face of a concrete structure, such as a pier, and where the installation of a curb is not possible or not desirable. It requires blocking out the thrie beam rail of the transition by 8" (200 mm) at the connection point. The designer needs to carefully weigh the relative merits of this potential loss of horizontal clearance, against the complications of adding a curb when selecting between the Type 6B terminal and the Type 6 for attachment to a structure.
6. Type 8. This is a connector terminal that includes a transition section, special posts, blockouts, and a turned-down connection to the top of the safety curb. Type 8 should be used only to repair existing installations until the bridge cross section can be reconstructed with a bridge railing and guardrail transition system accepted under NCHRP 350 and approved by the Department.
7. Type 9. This is a connector terminal to transition from tubular thrie beam retrofit to steel plate beam guardrail. It should be used only to repair existing installations until the bridge cross section can be reconstructed

with a bridge railing and guardrail transition system accepted under NCHRP 350 and approved by the Department.

8. Type 10. This is a connector terminal that should be used to connect steel plate beam guardrail to the departing end of existing one-way bridges.
9. Type 11. This is a connector terminal that should be used to connect temporary bridge railing to temporary concrete barrier. Specifications for the temporary concrete barrier require that the last segment of barrier be fixed in place by anchor pins. These pins are critical to the performance of this terminal in order to avoid a potential "pocketing" location for impacting vehicles.
10. Type 12. This is a terminal for use to shield the end post(s) of the bridge and to terminate tubular thrie beam on the departing end of one-way bridges that have the tubular thrie beam retrofit for bridges, and when there is not warranting criteria for additional steel plate beam guardrail off the end of the bridge. Because there is no NCHRP 350 accepted transition from the tubular thrie beam retrofit rail for the approach end, this terminal should be used only for repairs of existing installations until the bridge cross section can be reconstructed with a bridge railing and guardrail transition system accepted under NCHRP 350 and approved by the Department.

38-7.04(d) Terminal Treatments (Median Barriers)

As with roadside barrier terminals, median barrier terminals present a potential roadside hazard for run-off-the-road vehicles. Therefore, the designer must carefully consider the selection and placement of the terminal end. If practical, the median barrier should be extended into a wider median area. See the Illinois Highway Standards, Specifications, Special Provisions, and the Department's approved list of NCHRP 350 devices for details and further information.

Type 3 (Special). These are proprietary end treatments that are accepted under NCHRP 350 and approved by the Department. They may be used as noses for Steel Plate Beam Guardrail, Type D, or Concrete Barrier. The list of approved devices is included in the Notice of Letting as a Special Notice. Not all of these devices may be appropriate for all installations. The designer should add a special provision to the contract if any of the devices should not be used. Contact the BDE for further guidance.

Type 4. This terminal does not meet the NCHRP 350 criteria and is no longer considered acceptable for use. The designer should provide an appropriate guardrail connector terminal at the bridge, length of need guardrail of other type(s), and a compatible guardrail end terminal. Guardrail may be flared according to Chapter 38 and the *AASHTO Roadside Design Guide*. Special grading plans may be needed to assure 10:1 or flatter foreslopes and adequate drainage in the runout area.

BDE PROCEDURE MEMORANDUM 30-02A

September 17, 2002

Page 6

Other. See the *AASHTO Roadside Design Guide* for other operational end terminals for median barriers. These may be used on a case-by-case basis. Consult the BDE for more information.

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